Windows™ *"Chicago"* Storage Device Driver Overview

Naveen Jain
Program Manager
"Chicago" Base
Microsoft Corporation

Agenda

- Introduction to “Chicago” base drivers
- Protect mode device driver architecture
- Real mode/protect mode take over (Safe Driver List)
- Removable media support

What's New In Windows *"Chicago"*

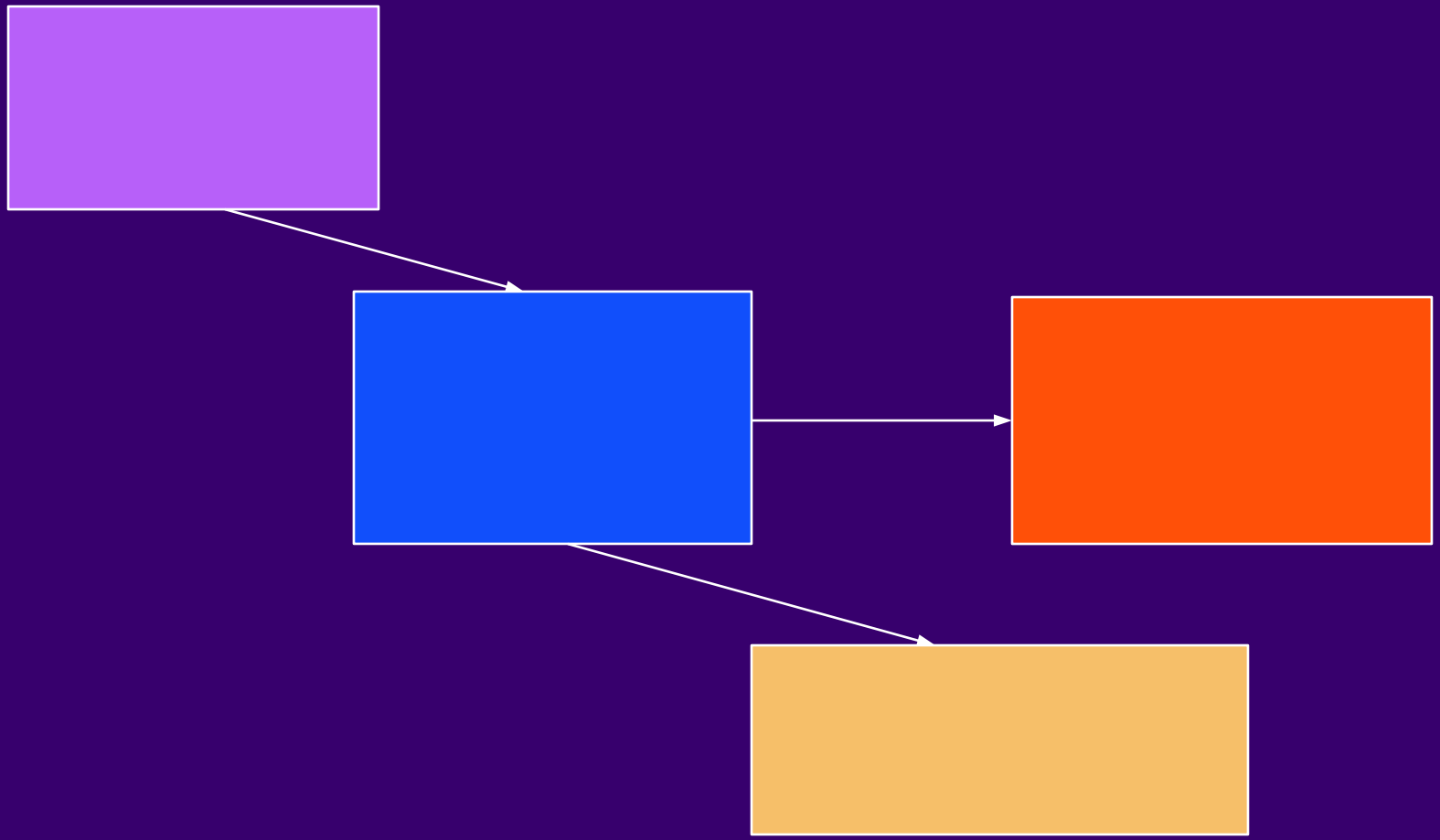
- Protect-mode layered driver architecture
- Enhanced IDE support
  - Large IDE drives (> 528 MB)
  - Two IDE controllers (four drives)
- SCSI support (backward compatible with Windows NT™)
- Removable media support
- ASPI/CAM support in protect

Windows *"Chicago"* Driver Philosophy

32-bit

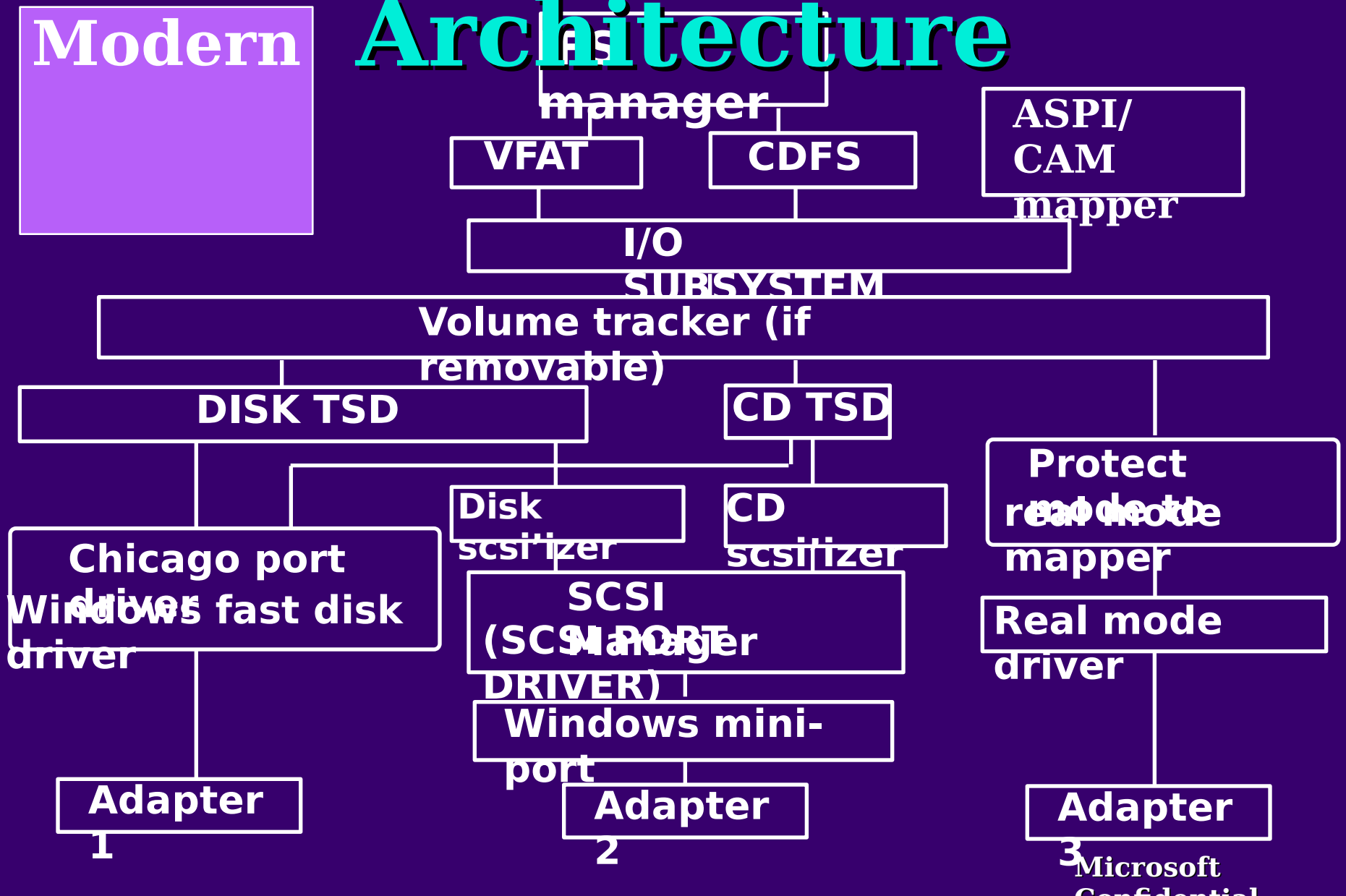
- Mini-driver/mini-port layered model
  - Leverages IHVs hardware knowledge
  - Leverages Microsoft® Windows knowledge
  - Increases system stability
  - Increases forward compatibility
  - Supports OEM/IHV innovation

Protect-Mode Driver Architecture



Device Driver Architecture

Modern



Block Drivers

- Two classes
  - Real-mode drivers (MS-DOS® 5 and MS-DOS 6 compatible)
  - Protect-mode block device drivers

Block Protect-Mode Drivers

- "Chicago" port drivers
  - Monolithic drivers
  - "Chicago"-specific - not portable to Windows NT
  - Example: "Chicago" IDE/ESDI port driver
- "Chicago" mini-port drivers
  - Binary compatible with Windows NT
- Windows 3.1 Fastdisk drivers

Block Driver - IOS

- I/O subsystem (IOS): provides services to file systems and drivers
  - Request queuing and routing
  - Driver registration
  - Asynchronous notification to drivers
  - Compatibility with BlockDev
  - Miscellaneous services: time-out, etc.

Block Driver - Volume Tracker

- Volume Tracker: for removable media only
  - Ensures correct media present in drive
  - Detects and reports improper media removal or insertion

Block Driver - TSD

- Type Specific Driver (TSD)
  - One per device type
    - Example types: disk, CD-ROM etc.
  - Converts logical request to physical request

Block Driver - SCSI'izer And SCSI Manager

- SCSI'izer
  - Constructs SCSI CDBs
  - Usually one per SCSI device type
- SCSI Manager
  - Provides Windows NT mini-port compatibility
  - Initializes mini-port

Vendor Specific Drivers

- Vendor Specific Drivers (VSDs)
  - Value-added functions such as encryption, cache etc.
  - Vendor-specific IOCTLs
  - SCSI 1 CD-ROM audio support

Block Driver - Mini-Port

- "Chicago" SCSI mini-port
  - Binary compatible with Windows NT mini-port
    - Extensions: Plug and Play and real/protect mode transitions
- Proprietary devices can emulate a SCSI interface
  - Transmits request to device
  - Handles interrupts

Block Driver - Port Driver

- Port driver
  - Used mostly for non-SCSI devices
  - Handles interrupt and adapter init
  - SCSI'izer and SCSI Mgr. layers not required

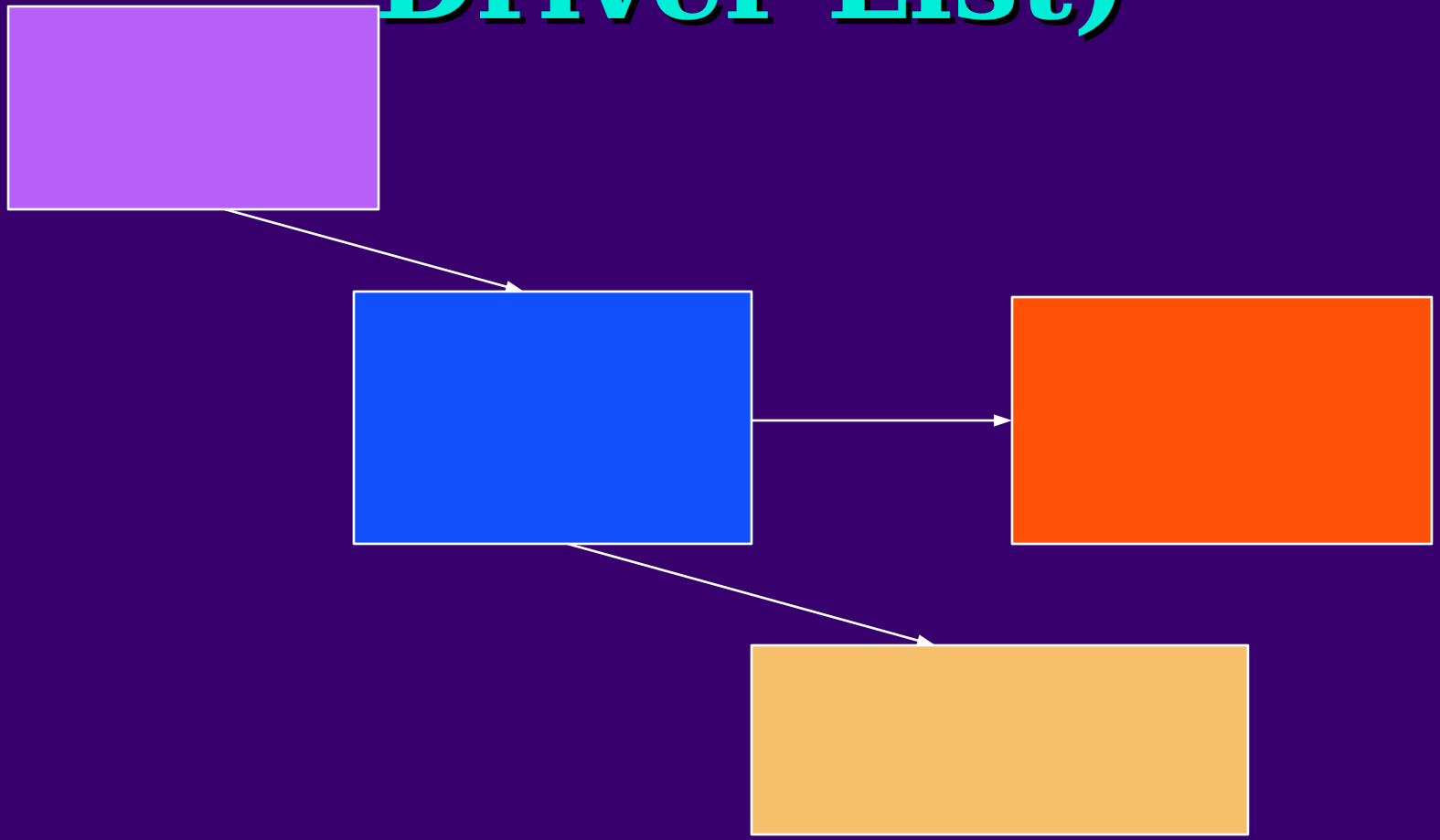
Block Drivers - Other Support

- Real mode drivers
  - Needed for boot devices
  - Protect-mode counterpart preferred
    - Takes over real mode driver only if the driver is in “Safe Driver List”
- Clients supported in “Chicago”:
  - Real-mode INT 13H, ASPI, CAM clients/drivers
  - 16-bit and 32-bit ASPI for Windows-based clients/applications

ASPI32 For Windows

- Implemented as DLL
  - Multitasking
  - Can accept function calls before previous calls are completed
- Exports two functions
- GetASPI32SupportInfo
  - Returns number of host adapters installed and other miscellaneous information
- SendASPI32Command
  - Sends ASPI32 command to the requested device

Real-Mode/Protect-Mode Take Over (Safe Driver List)



What Is A Safe Driver List?

- List of real-mode device drivers and other INT 13 hookers that can be safely taken over by the protect mode drivers
- To help construct this list, please fill in the handout provided and return to Microsoft

Why Do We Need A Safe Driver List?

- Protect mode driver should provide functionality that is a superset of its real mode counterpart
  - For example: Real-mode drivers providing disk geometry translation or encryption should not be taken over unless a protect-mode counterpart exists

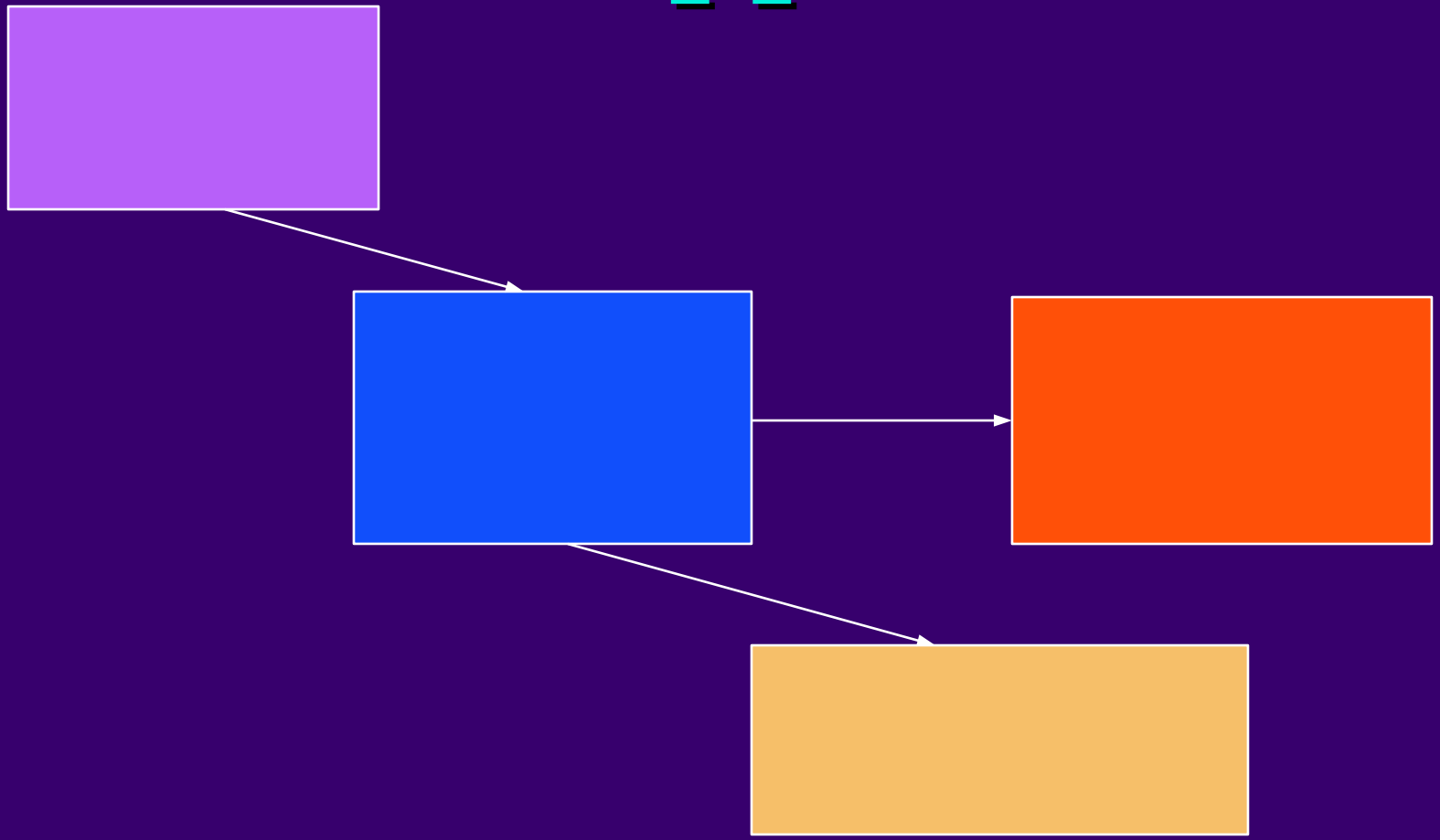
What Type Of Drivers Are Affected?

- Real-mode block device drivers
- ASPI managers
- CAM managers
- INT 13 monitors (monitors I/O)
- INT 13 hookers (modifies I/O)
- INT 13 drivers (monolithic driver, talks to hardware)

“Unsafe” Real-Mode Drivers

- Any driver providing the following functionality is probably “UNSAFE”
  - Data compression
  - Data encryption
  - Disk mirroring
  - Bad sector mapping
  - Fault tolerance
  - Vendor-specific IOCTLs

Removable Media Support



Removable Media

- Drive letter assignment
  - Drive letters set to number of partitions on media at bootup
  - Defaults to one if no media present at bootup
    - The number of drive letters in this case is user setable
  - Inserting media with more partitions triggers warning message

Removable Media

- Partitions
  - Existing MS-DOS-compatible partitions supported
  - FDISK works on any INT 13 device
- Drive geometry
  - IOS recalculates geometry on media change

Removable Media

- Volume tracking
  - First mount assigns unique serial number
  - Changeline support assumed only when one detected

Removable Media

- Lock and unlock
  - Two possible APIs
    - INT 13, MS-DOS IOCTL
  - Only first lock sent to hardware
    - Keep reference count
  - Unlock sent when ref count goes to zero

Removable Media

- Eject
  - Application, shell, or user action can cause eject
  - File system drivers flush buffers
  - Eject sent to hardware if reference count is zero
  - If reference count non zero, user advice requested

Call To Action

- Implement mini-port drivers and driver extensions for “Chicago”
  - Optimum performance
  - Plug and Play
- Help identify “Safe Driver List”
- Implement value-added drivers
- Build removable media devices which signal the OS on media change requests
- Attend the Windows™ Hardware Eng. Conf.
  - San Francisco, February 23-25, 1994